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An Economic Analysis on the Use of Resources Allocated for Defense: An Empirical Study on Turkey

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ABSTRACT

In this study, the aim was to investigate the relationship between Turkey's defense expenditures and its gross domestic product, foreign debt, and unemployment. Data was taken from a period between 1998 and 2020, and was examined using both the Toda-Yamamoto causality test and the time-varying recursive evolving window causality test developed by Shi, Phillips and Hurn (2018). According to the findings of the Toda-Yamamoto causality test, it has been observed that there is causality from defense expenditures to gross domestic product, that is, the change in defense expenditures affects the gross domestic product. Similarly, causality has been determined from defense expenditures to external debt. Test. According to the Shi, Phillips, and Hurn (2018) causality test findings, there was no causality from the expenditures for defense to unemployment but for all others (from expenditures on defense to GDP, from GDP to expenditures on defense, from expenditures on defense to external debt, from external debt to expenditures on defense, and from unemployment to expenditures on defense) a causality was observed. Therefore, it is possible to state that the change in defense expenditures will have an impact on foreign debt. In this respect, the findings are in agreement with the literature. The increase in defense expenditures will increase the production of the defense industry, the export of this product will result in a resource inflow to the country and the gross domestic product will increase. On the other hand, in some countries, defense expenditures will be financed by debt from foreign sources, which will cause an increase in their foreign debt.

Keywords: Defense Resources; Defense Expenditures; Gross Domestic Product; Causality; Foreign Debt; Unemployment

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INTRODUCTION

There are many sub disciplines found under the roof of economics. Some major sub disciplines are; microeconomics, macroeconomics, labor economics, public economics, etc. One of the newest sub disciplines relates to the defense sector and is referred to as defense economics. Although studies on this particular area began in times of World War II, only recently that its importance was actually understood and the number of studies on it increased. It was the seminal work of Benoit (1973, 1978) that sparked up the area to investigate the relationship between the government's spending on the defense sector and its contribution to economic growth. A country's defense system has a crucial role in the way that it is run whether it's for protecting its borders, its national security, or for its overall industrialization and development. For this reason, it requires a carefully planned strategy and an optimal allocation of resources.

Governments in both developing and developed countries place great importance on defense spending, making it a major component of their expenditures. Of course, the burden for defense varies among different countries as economic, social, political, or technological factors all contribute to this burden within the domestic and international arena (Tekeoglu 2008). Therefore, it can be said that the determination of the amount of resources allocated for defense is affected by economic factors as much as political and military factors.

Today, the struggle to obtain scarce resources all over the world causes tension, conflict and power struggles at various levels among countries. Examples can be; the Russia-Ukraine war, Israel-Palestine conflict, tensions experienced in Syria, Afghanistan, Iraq, conflicts among Azerbaijan-Armenia, Turkey-Greece, USA-China, Iran-US-Israel, and the Myanmar conflict. On top of that, the approaches and policies of global alliances such as NATO and the European Union cause countries to allocate more resources to defense. Likewise, imperialist demands and

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desires of countries such as USA, Russia, England, France, and Germany increase these tensions experienced nearly in every region of the world, and cause these countries to be more exposed to terrorist and irregular attacks. Thus these countries reconsider their defense needs and the resources allocated to defense.

Although the determination of the resources allocated to defense seems to be an ordinary subject in the literature, it is increasing its importance day by day due to the developments mentioned above. The unrealistic and insincere approaches of the great states to the preservation and maintenance of peace in the world mean that countries can allocate more resources for their own defense now and in the future in comparison to their other expenditures.

When a country allocates more resources to defense, it becomes a market for countries with large production power in the arms production sector, and sometimes regional conflicts can take place for these markets because weapons have high added value and therefore, large incomes can be obtained with the sale of weapons in these markets. Large arms producer and dealer countries can become a great economic, political and military power thanks to the privileges and incomes they obtain through arms production, and they can have an important position within alliances such as the United Nations, NATO, and the European Union, and cause a change in international balances.

Although there has been a symmetrical defense approach accepted by these countries in the past, recently, it is seen that a more asymmetrical defense approach has been utilized (Kucuksahin et al. 2007). Deterrence and protecting national interests form the basis of this understanding and, hence, a more proactive, rather than reactive, the approach is sought. In other words, a country must always be ready to protect its security.

Based on their economic, political, and cultural interests, the amount each government is willing to allocate to their defense spending will vary. The recent trend among defense economists has been to continue the work of Benoit (1973) and establish a relationship between the amount of government spending on defense and the country's economic growth. Unfortunately, earlier studies provide mixed results for this relationship due to differences in the countries observed, the time periods are taken, or from using different methodologies (Chen et al. 2014).

However, as the number of studies increases and the topic become more mature it is likely that impact of variables like economic development, geographic locations, growth on defense expenditure, and the implications they have on the defense-growth nexus will be understood and addressed in detail. This research was conducted with the purpose of contributing to existing pool of work on the topic through determining the relationship and interactions of defense expenditure with the macroeconomic variables such as gross domestic product, foreign debt, and unemployment in Turkey. Although there are many studies on the topic utilizing various different techniques, this study uses yearly data from 1998 to 2020 to use in the Toda-Yamamoto Causality Test and the time-varying recursive evolving window causality test developed by Shi, Phillips and Hurn (2018). It contributes to literature first and most importantly due to the country it is applied to. Turkey is located in a unique geography and because of it has been in the middle of many conflicts. Due to its geopolitical position, has been exposed to constant terrorism, and in recent times have experienced conflicts with Greece, Syria, the USA, and Russia. Secondly, the data used is still more relevant when compared to previous literature, from which much information can be gathered on how Turkey allocates its resources for defense.

The study starts with an introduction in Section 1 providing a background on the issue. Section 2 will discuss the theoretical background to the relationship between GDP, foreign debt, unemployment with defense expenditure. Section 3 will then follow with the relevant review of past literature in order to observe and analyze the findings from previous studies. Section 4 will provide the data used and the methodology applied followed by the results of the tests in Section 5. In the last part, Section 6, the conclusion will be drawn based on the results of the study.

GROSS DOMESTIC PRODUCT, FOREIGN DEBT, UNEMPLOYMENT AND DEFENSE EXPENDITURE

Gross domestic product (GDP) can be expressed as an economic measure that tries to quantify value of the products in the market which are produced at a specific period of time. GDP is calculated annually for any country and, in general, includes all government, investment, and consumption expenditures (Mishkin 2004). Generally, the relationship among external debt and GDP as well as growth is inverse in nature. This is because when external debt increases, the country's increased external debt payments will limit government

Table 1: Turkey's GDP between 1988-2020 ($ Billion)

Years	GDP	Years	GDP	Years	GDP
1988	90.853	1999	256.386	2010	776.986
1989	107.143	2000	274.303	2011	838.786
1990	150.676	2001	240.303	2012	880.556
1991	150.028	2002	240.249	2013	957.799
1992	158.459	2003	314.595	2014	938.934
1993	180.170	2004	408.865	2015	864.314
1994	130.690	2005	506.315	2016	869.683
1995	169.486	2006	557.076	2017	858.989
1996	181.476	2007	681.321	2018	778.382
1997	189.835	2008	770.449	2019	761.425
1998	275.967	2009	649.289	2020	649.440

Source: World Bank

and investment expenditures and hence, the growth rate will decrease (Cesares 2015; Checherita et al. 2010). The size of external debt is measured by the dividing debt by the GDP. It is a public service for the state to provide the country's defense. The power created to provide this service is called the defense power, and the expenditures for the defense power are called defense expenditures. Defense expenditures can be seen as an invoice given for the service provided for the country's defense. Defense spending can be grouped under 3 main headings: expenditures for military/defense/strategic purposes; expenditures for former military forces/activities, and expenditures for other forces (Giray 2004).

Table 1 below shows the GDP values obtained for Turkey, starting from 1988 until 2020. These values will also be utilized in the study to understand their relation to defense expenditures. Figures indicate that especially after 2005, significant increases were recorded in GDP, which lasted until 2017, and then a decrease was observed until 2020.

Turkey's defense expenditure values, external debt ratio, unemployment rates as well as its defense expenditure/GDP ratio between 1988 and 2020 is given in Table-2 below. The figures indicate that while Turkey's defense expenditure was an average of 11-12 billion dollars annually until 2015, a significant increase was recorded in 2016 until 2020. From the results defense expenditures/GDP ratio is observed to be around 2.4% between the years examined. According SIPRI (2021), the ratio of defense expenditures to GDP of USA, Russia, England, France, Germany, Italy, Spain, Greece, and Turkey is around 3.7%, 4.3%, 2.2%, 2.1%, 1.4%, 1.6%, 1.4%, 2.8% and 3% respectively. Between the years examined, the ratio of external debt to GDP was generally between 40% and 50%. According to Table-2, while the unemployment rate in Turkey was around 10% between 1988 and 2018, a significant increase was observed in 2019 and 2020.

Studies show that there are a few different ways that defense expenditure can affect economic growth. Although some argue that this effect is positive, as in a positive correlation (Benoit 1978; Ateşoglu and Mueller 1990; Ateşoglu 2004; Yıldırım et al. 2005), there are studies indicating that an increase in defense expenditure can decrease growth or prevent it (Deger 1986; Deger and Smith 1983; Heo 1999; Kwabena 1989; Lim 1983; Shieh et al. 2002; Grobar and Porter 1989; Lipow and Antinoiri 1995). Ali and Ather (2015) express that spin-off effects, allocation of resources, and creating new resources, are the three main mechanisms, which influence economic growth. Deger (1986) explains that in conditions under which supply potential is more than the aggregate demand, then every additional demand that is generated can be very productive. In other words, increasing defense expenditure will cause a higher aggregate demand that can result in higher utilized capital stock, more employment opportunities, and hence, a boost in investments leading to a short-run multiplier effect. Defense workers may also utilize this increased expenditure through engaging in research and

Table 2: Turkey's Defense Expenditure, Defense Expenditure/GDP, External Debt and Unemployment Rates Between 1988-2020

Years	Defense Expenditure* ($ Billion)	Def..Exp. /GDP** (%)	Ext. Debt** (%)	Unemployment ** (%)
1988	5.708	6,282676411	46,404	8,04
1989	6.605	6,164658447	39,667	8,26
1990	7.981	5,296795774	33,357	8,02
1991	8.204	5,468312582	34,518	8,21
1992	8.630	5,446203750	36,289	8,51
1993	9.541	5,295554199	38,666	8,96
1994	9.328	7,137500956	51,991	8,58
1995	9.583	5,654154325	44,372	7,64
1996	10.725	5,909872380	45,156	6,63
1997	11.178	5,888271394	45,348	6,84
1998	11.712	4,243985694	35,517	6,89
1999	12.932	5,043957158	40,225	7,69
2000	12.516	4,562837446	43,211	6,50
2001	11.473	4,774389001	57,405	8,38
2002	12.208	5,081394720	54,944	10,36
2003	11.353	3,608766827	46,621	10,54
2004	10.550	2,580313796	39,583	10,84
2005	10.168	2,008235980	34,665	10,64
2006	10.644	1,910690821	38,295	8,72
2007	10.263	1,506338422	38,520	8,87
2008	10.411	1,351289962	38,090	9,71
2009	11.140	1,715722891	43,456	12,55
2010	10.943	1,408390885	39,051	10,66
2011	11.036	1,315711040	36,748	8,80
2012	11.307	1,284075062	38,769	8,15
2013	11.612	1,212362928	41,125	8,73
2014	11.697	1,245774463	43,628	9,88
2015	12.036	1,392549467	46,798	10,24
2016	14.112	1,622660211	47,579	10,84
2017	15.147	1,763352034	53,846	10,82
2018	19.225	2,469866980	58,186	10,89
2019	20.603	2,705847588	58,880	13,67
2020	19.567	3,012903424	41,400	13,92

**Source: SIPRI*

***Source: *World Bank*

development, getting educational training, improving their technical skills, or investing it in new technology (Benoit 1973). For this reason, any increase in this demand created by the defense sector will lead to growth in the long term.

Resource allocation may be another factor causing defense expenditure to affect growth. When governments increase their expenditures on their defense it means there will be fewer funds available for other investments and can render economic growth of the country. One way to express it is as the opportunity cost of higher defense expenditure. Allocating resources has a direct impact on growth.

However, when new resources are created this is referred to as an indirect way for defense expenditures to influence economic growth. Within economies that are experiencing constraints in their aggregated supply, defense expenditure is regarded as inflationary. This situation leads to higher profitability and attracts investments, which will boost the growth in economy. However, it must also be considered that as the expectation of continually increasing inflation changes consumption and spending patterns. Higher inflation expectation is said to increase consumption, hence decreasing the amount of savings. With lower savings, investments will drop and the growth potential of the economy will be much lower (Ali and Ather 2015).

Macroeconomic variables are related to each other either in the same or the opposite direction. In other words, macro variables are either in relation or in contradiction with each other. When an economy starts to grow, it means investing more, producing more, and increasing capacity utilization. The natural result of these means more employment. In other words, unemployment should decrease in an economy where growth accelerates (Eğilmez 2013).

On the other hand, the fact that underdeveloped and developing countries cannot obtain the funds they need to ensure their development from domestic sources causes foreign borrowing. External debt, which is an additional resource for the country's economy, is expected to increase economic growth by using it to finance investments. The high levels of external debt taken over time and the increase in the country's external debt burden brought along high debt payments. The use of borrowings in debt and interest payments has also led to debates pointing on the negatives of having an external debt on the growth of the economy (Biçer 2020).

LITERATURE REVIEW

There is a vast amount of literature investigating how defense expenditure is used, its relationship with different macroeconomic variables, as mentioned above, or whether it contributes to the economic growth of a country. These studies can be classified in many ways such as according to the views it supported, the methodology used or the data used, and so on. Researchers are seen to look for common features, similarities among countries to obtain an understanding regarding the results obtained. Looking at a few of these studies will contribute to this paper and be able to summarize the discussions on the topic. These involve discussions on whether governments or countries can boost economic growth by increasing expenditure on defense.

There are few studies within past literature, which show that macroeconomic variables and defense spending have an inverse relationship (Pieroni 2009; Duyar and Kocoglu 2014; Korkmaz 2015; Cevik and Bektas 2019). It is interesting to see that although they involve different geographical areas and different countries, their results supported one another. Study by Pieroni (2009) was seen to focus on countries with high military spending levels. The results of it pointed out to a negative relation between spendings on the military and the country's growth. Duyar and Kocoglu (2014) conducted a study on 55 Sub-Saharan African countries and found that military expenditures did not make a positive contribution to the economy, that African countries directed their already scarce resources to military expenditures, and they did not give priority to policies and strategies which focus on the country's development both economically and socially. It was determined that it causes them to fall behind in economic and social areas compared to other countries of the world. Korkmaz (2015) conducted a study on 10 Mediterranean countries between 2005 and 2012, after the Arab Spring. The study investigated the unemployment and growth in the economy and how these were affected by the expenditures to the military using a panel data analysis. Results showed that military expenditures negatively affected economic growth and increased unemployment.

However, just as this study, Cevik and Bektas (2019) have investigated relationship of expenditures relating to defense and the growth in the Turkish economy both in the short and the long-term for the years between 1967 and 2017. It was shown that the causality from these expenditures on defense and the growth experienced in the economy was unidirectional in the long run, and unexpected increases in defense expenditures had adverse effects on GDP.

One of the recent works was by Azam (2020) where the focus area was interesting and was on the countries other than OECD member countries. Altogether 35 countries/markets were investigated using data covering the period between 1988 and 2019. Findings showed that there exists an inverse relationship between the two and that military expenditure should not be encouraged if economic growth needs to be established.

Another comprehensive study was conducted by Torun et al. (2021) where 26 NATO countries were examined using data from 1991 to 2016. Looking at the long-term results, it indicated that while the effect of defense expenditures was negative, both employment rates and fixed capital investment values had a positive effect on

the countries' GDP.

Rahman and Siddiqui (2019) have seen to approach the issue from a different perspective by saying that a direct effect of military spending on GDP does not exist. But rather than, it was mentioned to have an indirect effect through lowering risk and providing stability.

However, as previously mentioned, there is controversy over the results. There are also studies pointing out that by increasing defense expenditure, the country's GDP will rise, unemployment rates will start to decline and there will be economic growth experienced in that country. Gentilucci (2002) has expressed that in recent years China's role has become more important not only as an economic but also as a military power which has led China to move towards becoming one of the world's military powers. It has been explained that the increase in Chinese military expenditures was entirely by the increase in China's GDP. On the other hand, work conducted by Dunne and Tian (2013) stated that decreasing expenditures for the military may not always be costly and can have a contribution to the improvement of economic performance, particularly in countries with developing economies. It was expressed in the study that military expenditures have a price and if a country wants to be strong militarily, it should invest in its own economy, and the best way to ensure national security is economic growth.

One of the supporting studies was of Sokhatskyi et al. (2020). Their results indicated that the variables analyzed had a positive effect on the growth of the economy. Also, expenditures for military were observed to have a higher correlation with GDP growth values when compared to public expenditures. Nugroho and Purwanti (2021) tested the interaction of population together with foreign direct investment, political stability, and the law with military expenditure to observe their effect on the economic growth of the country. The study conducted on India by Abdel – Khalek et al. (2020) and on Nigeria by Temitope and Olayinka (2021) have also provided supporting arguments.

DATA AND METHODOLOGY

The purpose of this study is to determine the relationship and interactions among expenditures on defense and gross domestic product, foreign debt, and unemployment in Turkey between the years 1998 and 2020. Defense expenditures, gross domestic product, foreign debt ratio, and unemployment rate values for the specified dates are obtained from SIPRI and the World Bank. Although the relations of all these variables with defense expenditures for Turkey have been discussed separately in different periods in past literature, it is considered that examining the interaction between the defense expenditures and the years of 1998 and 2020 will have great contributions to the existing literature on the topic.

To be able to test for the existence of a relationship among the variables firstly, descriptive statistics will be analyzed. This will then be followed by a correlation analysis between Turkey's defense expenditures and gross domestic product, foreign debt ratio, and unemployment rate values.

In the third stage of the analysis, it is necessary to determine whether the series contains a unit root, that is, whether they are stationary or not. To begin with, first-generation unit root tests (ADF, PP), that do not take into account structural breaks, were used to determine whether the series were stationary or not.

Stationarity within time series means both variance and mean of the series stays constant. The covariance of the series becomes dependent on the delay from one period to another, and there is no time-dependency (Atik et al. 2015). If the time series is not stationary, it will contain a stochastic or deterministic trend. The mean, variance, and covariance of time series that are stationary are independent of time and do not change over time. Such a time series will show constant width oscillations around its mean. This feature of the series is called mean reversion. Stationary series are also used in the literature with different names such as weak stationary and covariance stationery. Assuming that Yt is a series to explain the stationarity;

$$E(Y_t) = \mu$$

$$Var(Y_t) = \gamma_0$$

$$Cov(Y_t, Y_{t+k}) = \gamma_k$$

When we bring the starting point from t point to t+k, if the Y_t series is stationary, the mean, variance and covariances of the Y_t, and Y_{t+k} series must be the same. But if k is 0; we can get

$$Cov(Y_t, Y_{t+0}) = Var(Y_t) = \sigma^2$$

If the time series is not stationary, it's mean, variance, or both will change over time. If the series is not stationary, the behavior of the series cannot be generalized for other periods and cannot be used to predict the future (Yalta 2011).

Therefore, to test the stationarity of the series, the Augmented Dickey-Fuller (ADF) unit root test, one of the first generation tests, was applied. This test is used for the assumption that the distribution of the error term is random and homogeneous and has different variances and serial correlations.

$$\Delta Y_t = \beta_1 + \beta_2 . t + \delta . Y_{t-1} + \alpha_i . \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

ΔYt = The first difference of the series whose stationarity is tested.

t= Trend variable,

ΔYt-i = Lag difference

εt= It is an error term with a mean of 0, no sequential dependence, and an unchanged variance.

In the ADF unit root test,

H0= α1=0

H1= α1<0, rejecting H0 means that the series is stationary and does not contain a unit root.

Following the unit root test, the causal relationship between variables must be established. Due to the different levels of stationarity of the series, it was deemed more appropriate to apply the Toda-Yamamoto causality test (1995) instead of the Granger causality test (1969). In the Toda - Yamamoto test, analysis can be performed without the need to make the series stationary. Thus, successful results can be obtained without the loss of information in the series. It is based on the Toda - Yamamoto Vector Autoregressive (VAR) model. In the VAR model, first of all, the optimal lag length (m) and the maximum stationarity level (dmax) of the series used are determined. Subsequently, a VAR model of size (m+$dmax$) is estimated (Toda and Yamamoto, 1995). The mathematical equation of the relevant VAR model is shown below.

$$Y_t = a_0 + \sum_{i=1}^{p+d_{max}} + \sum_{i=t}^{p+d_{max}} a_{2i} + u_t \qquad (2)$$

$$X_t = \beta_0 + \sum_{i=1}^{p+d_{max}} \beta_{1i} + \sum_{i=t}^{p+d_{max}} \beta_{2i} Y_{t-1} + v_t \qquad (3)$$

The hypotheses of the related equation;

H_0: The relationship from Y to X is not causal

H_1: The relationship from Y to X is causal

The model needs to be able to satisfy the stability condition of the VAR model and this need to be determined. Root AR diagram method states that, when the inverse roots of the AR characteristic polynomial falls below 1, that is, if they are inside the unit circle, the model can be said to be stable (Dan et al. 2014). According to this, it is seen in Figure-1 that the inverse roots of the autoregressive characteristic polynomial of the estimated VAR model are distributed within the unit circle and satisfy the stability conditions.

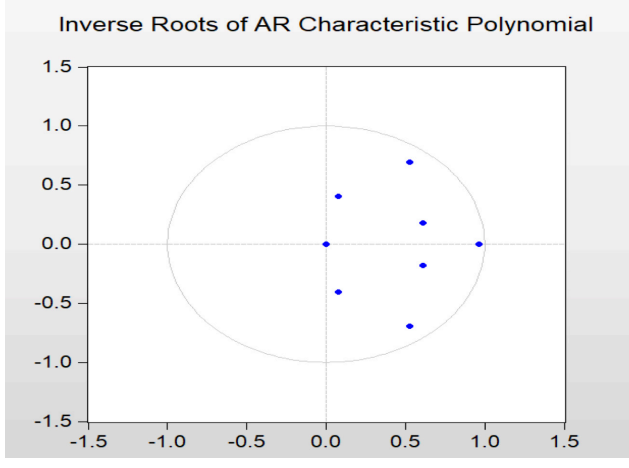

Figure 1: Distribution of Unit Roots of the AR Function in a Circle

RESULTS

In the first stage of the analysis, descriptive statistics data are given in Table 3. According to the values obtained, the standard deviation of Turkey's external debt and unemployment rates in the surveyed periods is higher than that of defense expenditures and gross domestic product.

Correlation coefficients between Turkey's defense expenditures and gross domestic product, foreign debt ratio and unemployment rate values are shown below in Table 4. By looking at the values from the table it can be said there exists a moderate correlation that is positive among defense expenditures and GDP, foreign debt ratio and unemployment rate. Among the analyzed independent variables (gross domestic product, external debt ratio and unemployment rate), there exists a very low correlation, which is also positive, between the GDP and foreign debt, and a moderate positive correlation among GDP and unemployment rate.

In the next stage of the analysis, ADF test was applied and the results obtained are given in Table 5. According to the table, it was concluded that some of the series

Table 3: Descriptive Statistics

Variable	Observation	Medium	Medyan	Maxsimum	Minumum	Standart Deviation
DEFEXP	33	9.316296	9.318298	9.933192	8.649624	0.267900
GDP	33	12.83380	12.92114	13.77239	11.41700	0.760611
EXTDEBT	33	43.40424	41.40000	58.88000	33.35700	7.133394
UNEMPLOY.	33	9.332727	8.800000	13.92000	6.500000	1.857753

Table 4: Correlation Analysis Results

Variables	lnDEFEXP	lnGDP	EXDEBT	UNEMPL
lnDEFEXP	1.000000			
lnGDP	0.655828	1.000000		
EXDEBT	0.496740	0.093349	1.000000	
UNEMPLOY	0.573715	0.568114	0.324443	1.000000

Table 5: ADF Test Results

		Constant		Constant+Trend	
	Variables	**t Stat**	**P Value**	**t Stat**	**P Value**
1.	LnDefExp	-1.4719	0.534	-1.8657	0.648
2	ΔlnDefExp	-4.1405	0.003***	-4.0679	0.016**
3.	lnGDP	-1.9713	0.297	-0.7517	0.959
4	ΔlnGDP	-5.4175	0.001***	-5.8635	0.001***
5.	ExtDebt	-3.3048	0.023**	-3.3747	0.073*
6.	Unemployment	-0.9693	0.752	-3.0889	0.126
7.	ΔUnemployment	-4.8011	0.001***	-4.8493	0.002***

*Note: The stationarity of the series was determined using the "Schwarz Information Criteria" (AIC) over a maximum lag length of 8. (stationarity at the 10%, 5%, and 1% significance levels are denoted by *, **, and ***, respectively).*

were stationary at the 95% confidence level ($p<0.05$) and the other series were stationary when the first difference was taken as I(1) ($p<0.05$).

The existence of a unit root indicates that the related variable is not stationary. From Table 5 it is seen that the stationarity levels of the variables vary. In addition, in the tests performed by taking the first difference of the series, there is information loss in the level values of the variables. In the analysis developed by Toda and Yamamoto (1995), this loss of information is prevented and the variables are included in the analysis with their level values. For this reason, Toda-Yamamoto causality analysis was preferred in the study. Toda-Yamamoto (1995) analysis is based on the VAR (Vector Autoregression) model which allows the model with level values to be estimated regardless of whether the data in question has a unit root or not. As a result, in the Toda-Yamamoto causality analysis, the unit root of the series and the existence of a cointegration relationship do not affect the analysis.

To apply the Toda-Yamamoto test, no autocorrelation must exist between the series. Therefore, the results of the Autocorrelation test are given below in Table 6.

The H_0 Hypothesis, which was established as no autocorrelation, could not be rejected and it was accepted that there was no autocorrelation.

Table 6: Autocorrelation Test

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	12.57405	16	0.7036	0.769983	(16, 46.5)	0.7092
2	13.87027	16	0.6084	0.860146	(16, 46.5)	0.6151
3	21.03438	16	0.1772	1.399893	(16, 46.5)	0.1837

Table 7: Toda-Yamamoto Test Results

Model	Direction	x^2	Lag	P Value	Explanation
1	DEFEXP-GDP	7.424345	1	0.006***	**Causality Exist**
	GDP-DEFEXP	0.448673	1	0.5030	No Causality Exist
2	DEFEXP-EXTDEBT	4.219434	1	0.040**	**Causality Exist**
	EXTDEBT-DEFEXP	1.643713	1	0.199	No Causality Exist
3	DEFEXP-UNEMPL	0.556210	1	0.455	No Causality Exist
	UNENPL-DEFEXP	1.354059	1	0.244	No Causality Exist

Note: *, **, and *** indicates that the "H0 No Causality" hypothesis is rejected at the 10%, 5%, and 1% significance level, respectively.

The dependent variable, which was stabilized in the last stage of the analysis, was Defense Expenditures and the independent variables; whether there exists a causal relationship among GDP, External Debt Ratio and Unemployment Rate series one by one, and if there is causality, in which direction it will be examined with the Toda-Yamato causality test.

Causality from expenditures on defense to gross domestic product was observed from the results of the causality test, in other words, the change in defense expenditures affects gross domestic product. Similarly, causality has been determined from defense expenditures to external debt; therefore, it can be stated that any change experienced in the expenditures on defense will, in turn, affect the external debt of the country. On the other hand, the causality relationship from gross domestic product to defense expenditures, from foreign debt to defense expenditures could not be determined. On the other hand, no bidirectional causality relationship could be determined between defense expenditures and unemployment.

In this study, in addition to the Toda and Yamamoto (1995) causality test, the time-varying recursive evolving window causality test developed by Shi, Phillips and Hurn (2018) was also applied to observe how the results differed when structural breaks and shocks were incorporated into the method to investigate the causal relationships. Using this test also helps to determine the starting and ending dates of the causality relationship and can allow for a clearer analysis.

Figure 2 shows the Mwald test statistics for the time varying recursive evolving window causality test. According to the results, it was observed that t Granger causality existed between the series in the years when the Mwald test statistics were found to exceed the critical values. Thus, this study provided the opportunity to compare the test results of Toda Yamamoto and the Time Varying Recursive Evolving Window.

According to Figure 2a, at the level of 90% and 95%, it was determined that there is causality from defense expenditures to GDP in 1996, between 2007 and 2012, and causality from GDP to defense expenditures in 2003 and between 2010-2015.

According to Figure 2b, at the level of 90% and 95%, it was determined that there is causality from defense expenditures to foreign debt in 1998, between 2007-2012 and causality from foreign debt to defense expenditures in 2008 and between 2016-2019.

According to Figure 2c, at the level of 90% and 95%; while no causality relationship was found from defense expenditures to unemployment in the years

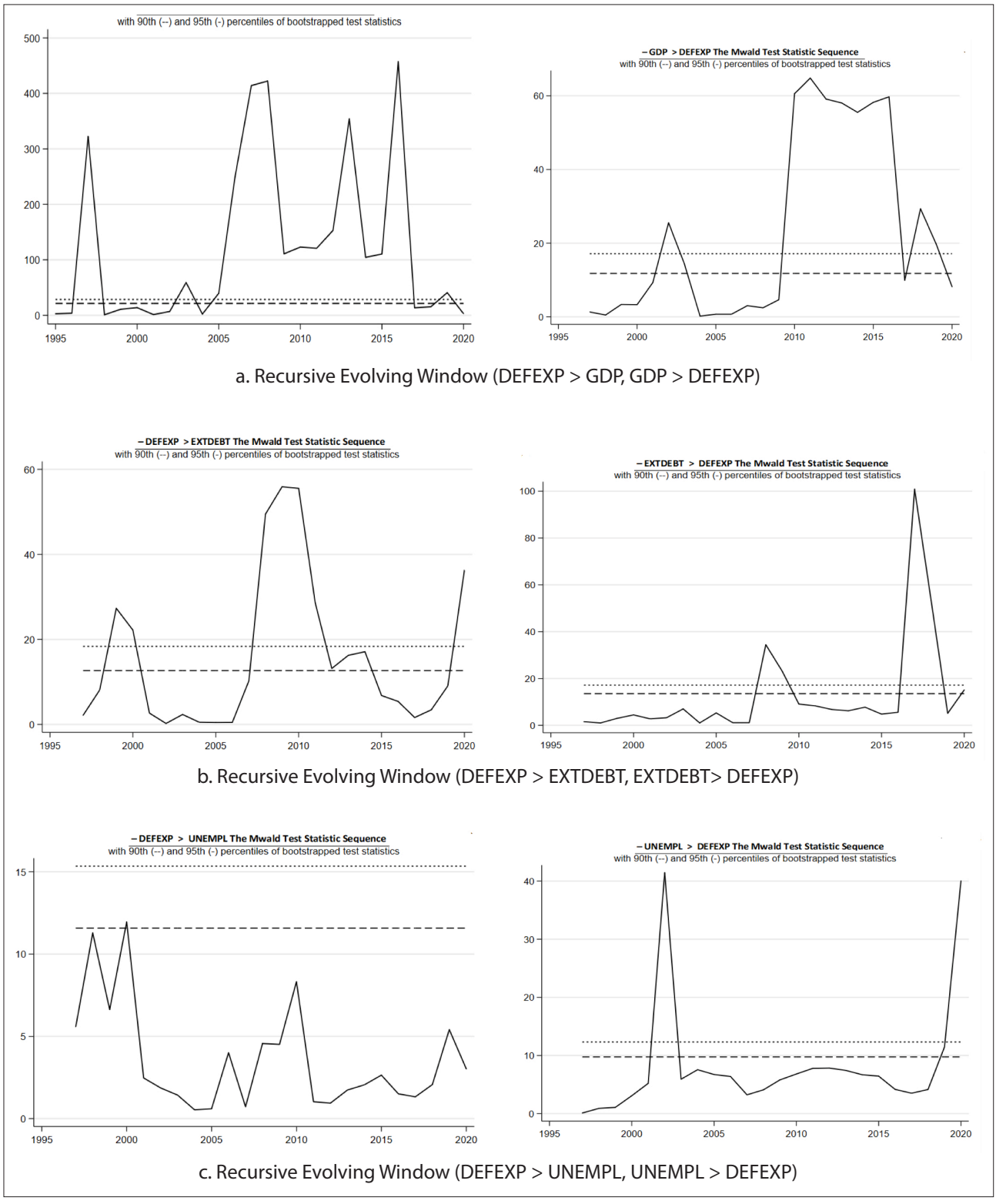

Figure 2: Time-Varying Granger Causality Test Results (Recursive Evolving Window)

examined, it was determined that there was causality from unemployment to defense expenditures in 2003 and between 2018-2020.

As stated before, the Time Varying Recursive Evolving Window does not focus on a single causal relationship in the entire sample; it can precisely show any causal relationship and the start and end dates of this relationship. Therefore, different findings were obtained in both Toda Yamamoto and Recursive Evolving Window test results. The differences of findings of the two causality tests are shown in Table 8.

Table 8: Comparison of the Toda and Yamamoto (1995) and the Shi, Phillips and Hurn (2018) Causality Tests

Explanation	Toda and Yamamoto (1995)	Shi, Phillips and Hurn (2018)
DEFEXP-GDP	Causality Exists	Causality Exist: 1996, between 2007-2012
GDP-DEFEXP	No Causality Exists	Causality Exist: 2003, between 2010-2015
DEFEXP-EXTDEBT	Causality Exists	Causality Exist: 1996, between 2007-2012
EXTDEBT-DEFEXP	No Causality Exists	Causality Exist: 2008, between 2016-2019
DEFEXP-UNEMPL	No Causality Exists	No Causality Exists
UNENPL-DEFEXP	No Causality Exists	Causality Exist: 2003, between 2018-2020

CONCLUSION

Determining the amount of resources allocated by nations for defense is a very important issue for countries from all around the world. The determinants of this amount allocated, but not limited to, are; geo-strategic positions of countries, conditions of peace and stability in the region, political and military preferences, and economic resources. Within the framework of these determinants, it is necessary to make an optimization by the country managers for the amount of resources allocated to defense. But the resources allocated for defense have alternative uses within the country under peace conditions. Therefore, the use of these resources is country specific. However, it needs to be known that these resources should be used effectively and efficiently, as each unit of the resource is very valuable.

Today, it is considered that countries finance their defense expenditures from their budgets and the special funds they create, and its size can reach up to 20%. It is considered that the use of such a large amount of resources and the determination of the relations between the country's other macroeconomic variables will contribute to the literature, especially for Turkey. Turkey is located in a unique geography and because of it has been in the middle of many conflicts. Due to its geopolitical position, has been exposed to constant terrorism, and in recent times have experienced conflicts with Greece, Syria, the USA, and Russia.

In the study, using Turkey's defense expenditures (dependent variable) between 1998 and 2020, the relationship between the variables gross domestic product, external debt and unemployment (independent variables) were investigated. First step of study involved using the Toda-Yamamoto Causality Test. According to the findings, it has been observed that there exists causality from expenditures on defense to gross domestic product, that is, the change in defense expenditures affects gross domestic product. Similarly, causality has been determined from defense expenditures to external debt. Therefore, it is possible to state that changes in expenditures on defense will have an impact on foreign debt.

Second step of study the causality test of Shi, Phillips and Hurn (2018) was applied to the data. This test allowed for structural breaks and included the shocks while showing the precise dates when causality started and ended. It was interesting to see that the findings obtained from this test varied from those obtained from the Toda-Yamamoto Causality Test. According to the Shi, Phillips, and Hurn (2018) causality test findings, there was no causality from the expenditures for defense to unemployment but for all others (from expenditures on defense to GDP, from GDP to expenditures on defense, from expenditures on defense to external debt, from external debt to expenditures on defense, and from unemployment to expenditures on defense) a causality was observed, but they varied in terms of the years.

Although defense expenditures vary from county to country, majority of the studies show a consensus on the issue that an increase in the expenditures on defense will cause an increase in the production taking place within the defense industry, the export of this production will result in a resource inflow to the country and the gross national product will increase. This study has supported these findings. However, the causality relationship from gross domestic product to defense expenditures, from foreign debt to defense expenditures could not

be determined. No bidirectional causality relationship could be determined between defense expenditures and unemployment. Some of the findings are not consistent with the studies in the literature. For example, although it has been determined in the literature that there exists an inverse relationship among defense expenditures and unemployment, in this study, no reciprocal causality was found between defense expenditures and unemployment. The reason for this can be considered as the difference between the sample in which the study was conducted and the periods examined.

At this point, one of the most important issues is to determine the optimal size of defense expenditures, which is public expenditure, within the national income. In accordance with NATO's Final Decision of the Wales Summit in 2010, this value has been determined as 2% of national income for countries (NATO, 2020). In the study conducted by Bayrak (2019), this value was determined as 2.5% for Turkey. This value is very important; because it will be possible to prevent unnecessary defense expenditures by determining the optimal value that encourages economic growth. Thus, it will be possible to ensure resource efficiency by transferring defense expenditures with high alternative costs to high value-added areas of the manufacturing industry or by transferring them to areas such as health and education that increase the level of intellectual capital and social welfare.

Major arms dealer countries around the world such as US, Russia, England, France, and Germany see the weapons and defense tools and equipment they produce as investments, in addition to using their defense expenditures in their own countries and in the regions where they have interests in the world, and in this sense, the weapons they produce are underdeveloped.

Thus, these findings are important to observe how defense expenditures affect of be affected by the country's macroeconomic variables, which gives us an idea about its economic growth. As previously mentioned, each country have different dynamics and profiles which cause them to employ different strategies when employing their resources for defense. However, there are some general statements found in literature, which have a global perspective. The results of this study were important to point out that the Turkish market also supported them. It still can be considered as early to make big and bold statements about the Turkish market from these results. There should be further research conducted using a different and bigger sample size, and to try and understand the reasons of these causalities found.

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